Children's Hospital in Haiti

Living Building Challenge

ENERGY

Electricity Consumption

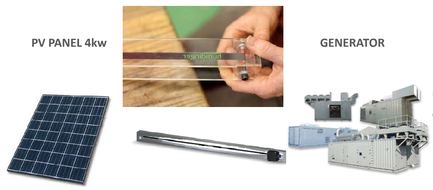
-Total demand 100% 120 kw
-Daily consumption 70% of usage demand 83 kwh
-Nightly consumption 53% of usage demand 63 kwh
-Emergency Demand 27% of usage demand 32 kwh

Budgets

WIND TURBINE:
WIND BELT & WINDCELL PANEL

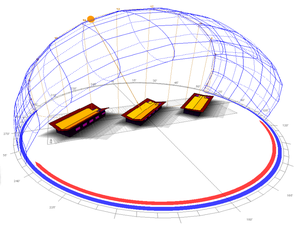
PV PANEL 4kw

GENERATOR



	Day	Night	Emergency
Lamps (commercial, economic energy saving T8/15W)			
Electric outlets (250W / 650W)			
Computers (250W)			
Big Ass Fan (270W)			
Refrigeration (600W)			
Special Lighting			
AC Operating Room			
Laundry			
Family Areas			
Emergency Light			

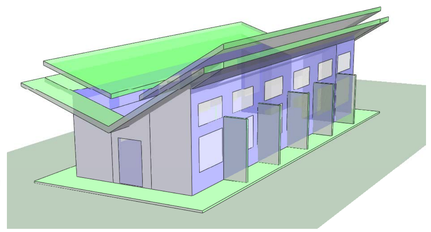
Orientation

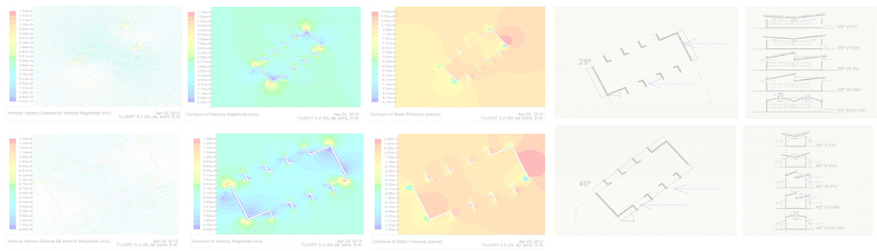


IES VE

Project summary

Total Yearly Energy Consumption 8.7MWh / 29.68 MBtu/h
Total Yearly Energy Consumption Per Floor Area = 95.4 kWh/m2 / 30241.6 Btu(hour)/ft2

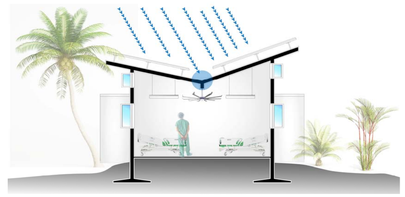




Bed ward design

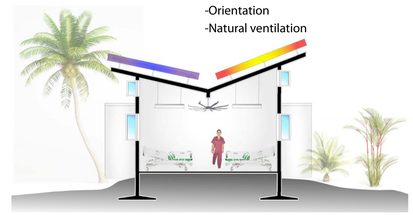
Rain water

- One of the purpose of the slopes is to storage water.



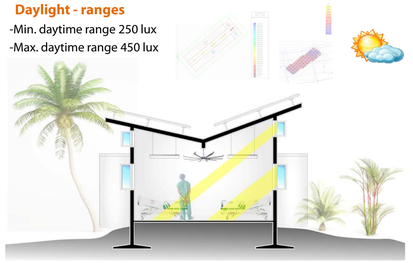
Thermal comfort
Heat load reduction

-Double roof
-BAF
-Insulation
-Orientation
-Natural ventilation



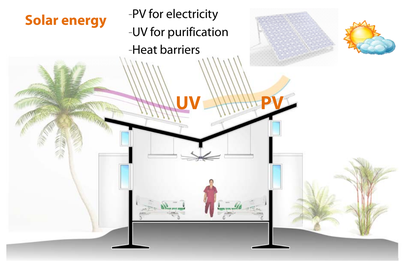
Daylight - ranges

-Min. daytime range 250 lux
-Max. daytime range 450 lux



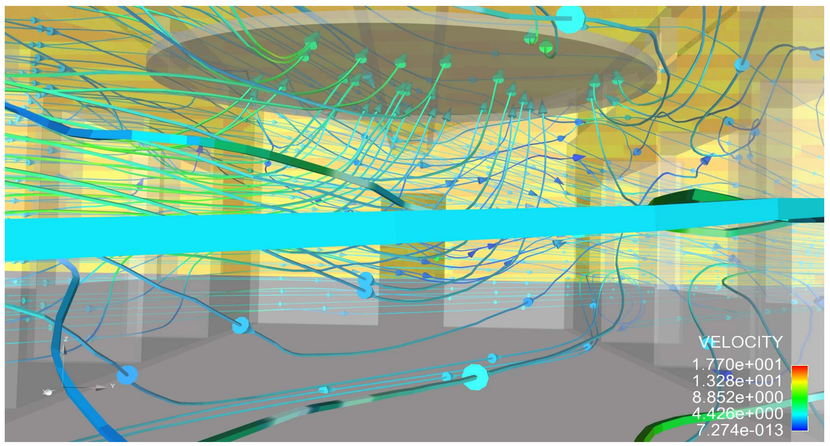
Solar energy

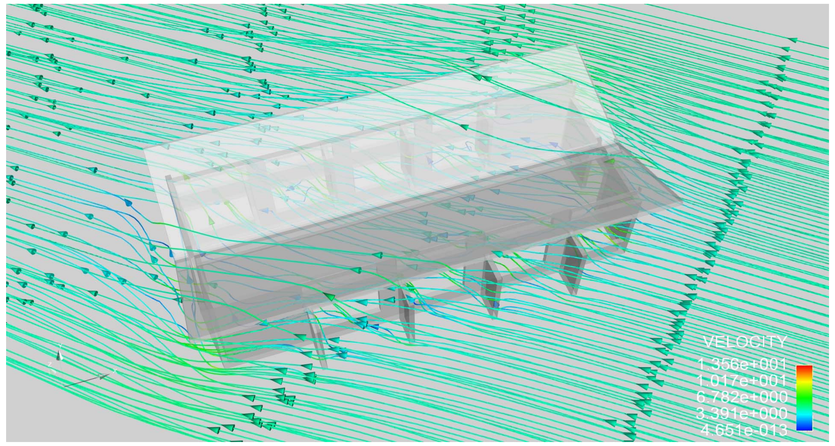
-PV for electricity
-UV for purification
-Heat barriers

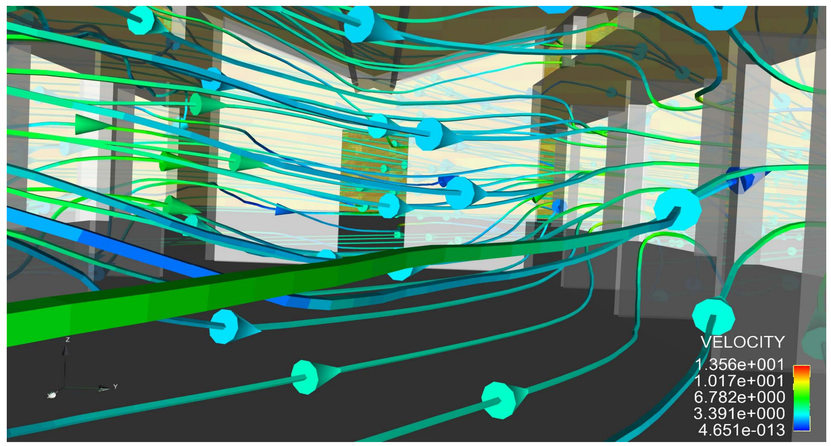


Natural ventilation

-Tested two options 40º and 20º_13mph East wind_6 air exchanges



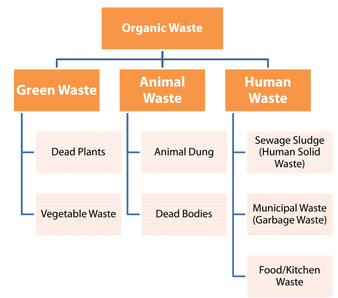




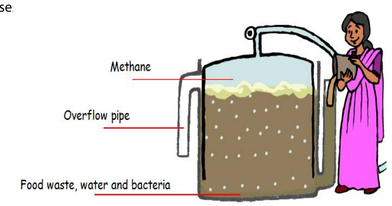
WASTE

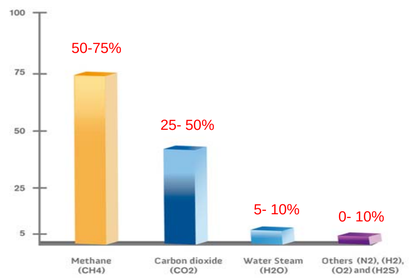
Biogas Sources & Composition:

Swamp gas – biological breakdown of organic materials.
Landfill gas (LFG) = Methane (CH4) + Carbon dioxide (Co2) + other gase



Biogas Sources





Biogas Composition

Organic Waste Budget

Organic Waste	kg/day	CUM
Human	0.4	0.1
Green Waste from fruits and vegetables + house hold food waste	1	0.1

http://www.finishsociety.com/page.php?page_id=63

X 300 Person → (300 x 0.1 CUM) = **30 CUM Biogas / day**

X 40 Kg → (40 x 0.1 CUM) = **4 CUM Biogas / day**

34 CUM / day
12,410 CUM / year

Energy and Heat Production:

1 CUM / day (BIOGAS) = 10.65 Kwh / day (Energy) = 36.34 Kbtu / day (Heat)

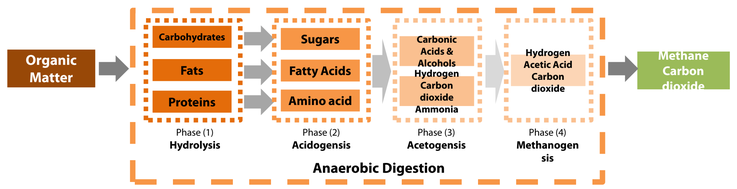
Thus: 34 CUM /day = 362 Kwh / day = 1235.56 Kbtu / day

Thus : 12,410 CUM / Year = 132 Mwh / Year = 451 Mbtu / Year

451 MBTU / year
132 MWh / year

Biogas Production Process :

The **Biogas Process** is a closed biological process without oxygen where organic matter is converted to biogas (methane and carbon dioxide) by microorganisms.

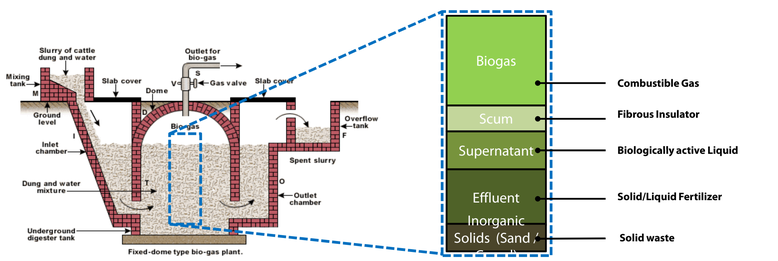


Biogas Plant Sizing:

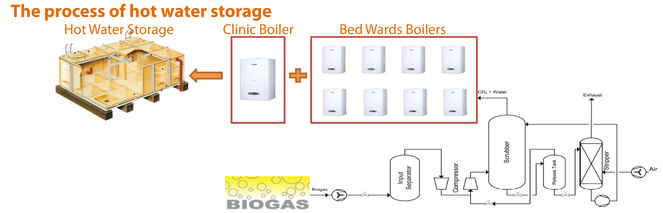
Biogas Plant Capacity	1:1 Water & Dung per day (Kg)	Well size , Diameter & Depth (m)	Biogas Production per day (CUM)	Fertilizer Production per day (Kg)
2 Cubic Meter	80	1.25x3.0	2	4-8
4 Cubic Meter	160	1.5x4.0	4	8-16
7.5 Cubic Meter	300	2.0x4.0	7.5	15-30
10 Cubic Meter	400	2.2x4.3	10	20-40

http://www.builditsolar.com/Projects/BioFuel/VITABIOGAS3M.HTM

34 CUM / 4 m3 capacity Plant = 9-10 Biogas Plants
16 Kg/day (Fertilizer) x 10 B.Plants = 160 Kg/day = 58,400 Kg/Year = 58.4 Ton/Year (Fertilizer)



The process of hot water storage



Illinois Institute of Technology – College of Architecture
Arch 552-01- **Design of Energy-Efficient Bldg II**
Prof. Matthew Herman

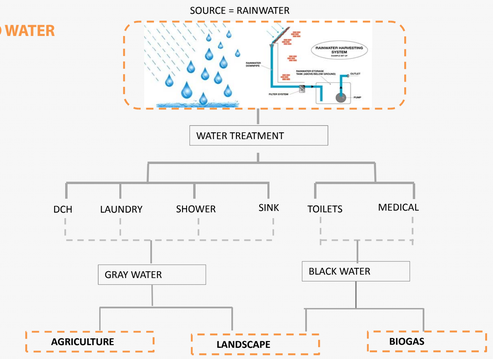
LBC PETALS
Water: Sakshi Aggarwal, K.Pinar Dursun, Soledad Hernandez ,Da Hee Sim, Bhumika Suthar
Agriculture: Domecq, CRISTINA, Mazagatos, MARINA
Health: ChanWoo KOO, EungJu YEON
Energy and Waste: Nghia Phan , Gilberto Osornio , Filip Dubrovski ,Dung Luu ,Ahmed Hassan , Ramin Ghods
Material: Denys Petrenko , Ghita Pop

Children's Hospital in Haiti

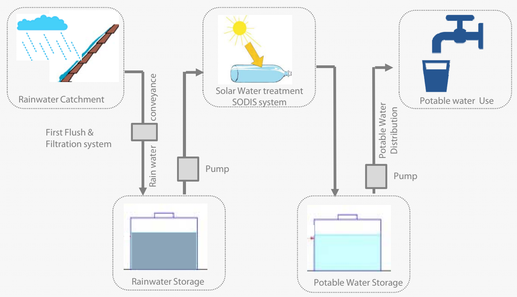
Living Building Challenge

WATER

NET ZERO WATER

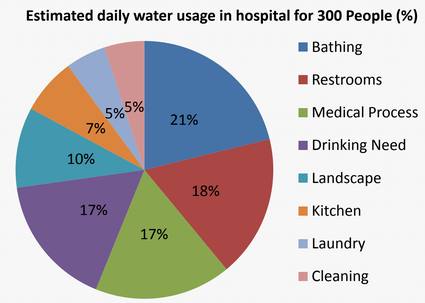


RAIN WATER TREATMENT PROCESS

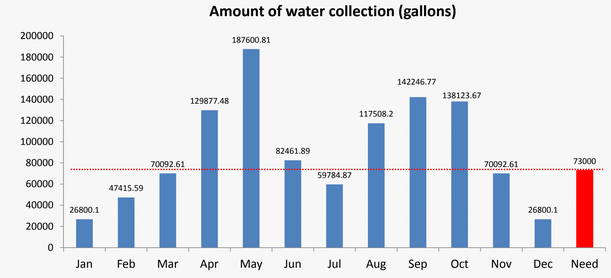


HOSPITAL WATER CALCULATION

Daily water consumption :8 gal x per 300 person=2400 gal.



Water collection :
Rainfall x Area x Evap.Co-eff.0.8 X 0.8 water tank efficiency x 0.95 first flush



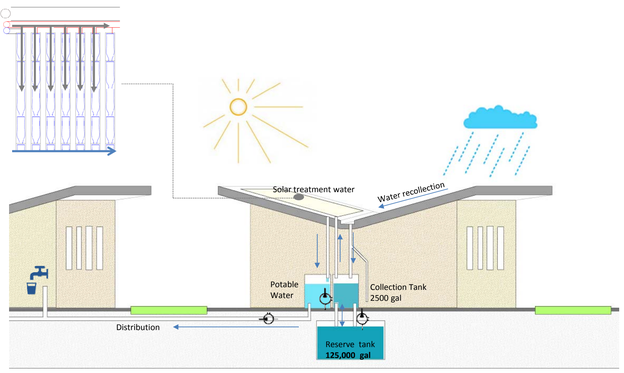
http://www.rainharvest.com/rain-harvesting-pty-first-flush-diverter-for-post-or-wall-mounting.asp?bc=no

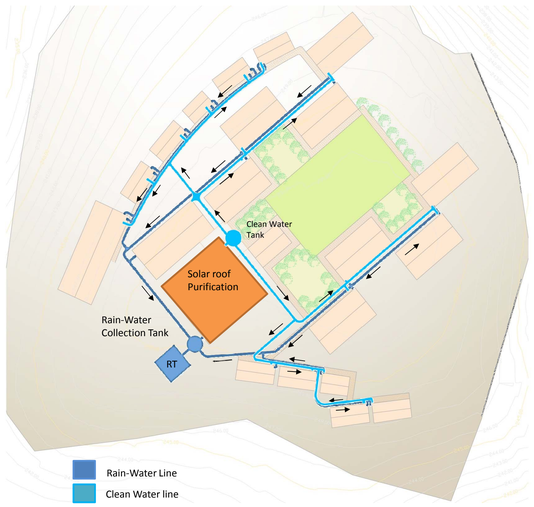
POTABLE WATER MASTER PLAN

Day water use: 2400 gal/day
Collection strategies:
Rainwater capture via sloped standing seam metal roof.
Systems fed: Potable water

Water Treatment :
Solar & Chlorination System
Treatment time: 6 hr or 2 day
Surface need: 352 m2= 3788 f2
Bottle 1 lt.: 6400

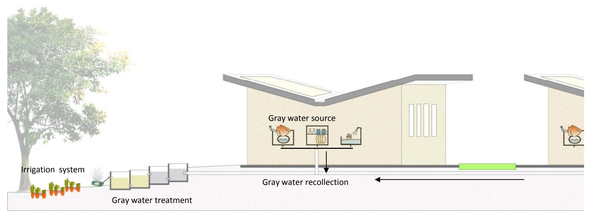
WATER TREATMENT PROCESS



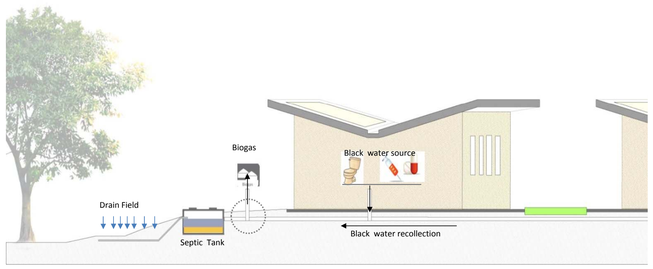


WASTE WATER MASTER PLAN

GRAY WATER 1027 gal/day

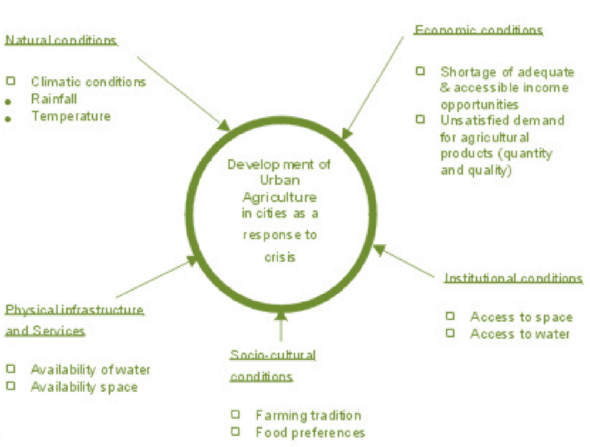


BLACK WATER 725 gal/day



URBAN AGRICULTURE

BASIC FACT – LOCAL CITY LEVEL

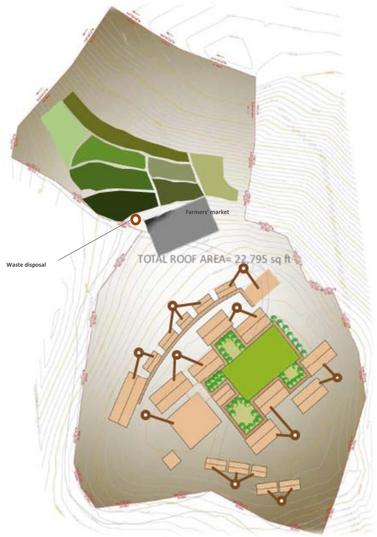


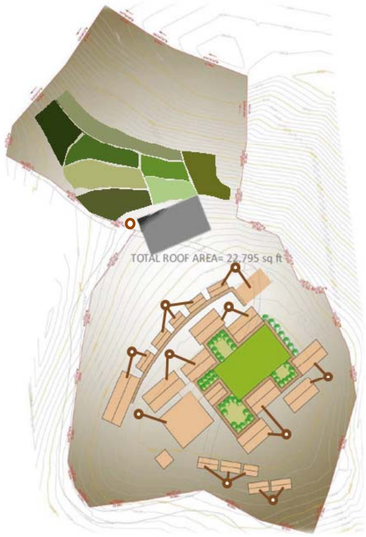
RECOMMENDED PLANTS

groupA_ONION, KALE, PEPPERS, CABBAGE
groupB_OKRA, EGGPLANT, AMARANTH, SPINACH, TOMATO, LETTUCE

AGRICULTURE BUDGE

Amount of water needed / Distance needed between plants and rows/ Seed depth/ Layout techniques





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